PINK: tender x-ray beamline for an x-ray emission spectroscopy at BESSY II

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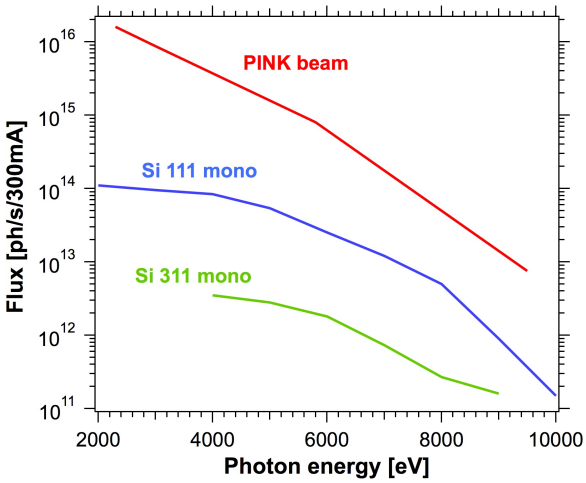
The PINK project is devoted to establishing a high-resolution x-ray emission spectroscopy (XES) setup at the BESSY II synchrotron ring, opening up "two-color" and time-resolved studies of catalytic systems at an unprecedented level.

Knowledge of the changes in the transition metal electronic structure and ligation environment are essential for any detailed mechanistic understanding, which forms the basis for rational catalysis design. XES measurements and analysis of x-ray emission lines can reveal the ligand identity, the ligand ionization potential and the metal-ligand distance. XES can also help to identify oxidation states of the extent of substrate activation.

The PINK beamline is designed to operate in the tender x-rays regime with energies ranging from 2 to 10 keV. This energy range will provide access to XES and XAS studies of transition metals ranging from Ti to Cu (Ka, Kb lines) and Zr to Ag (La, Lb lines), as well as light elements P, S, Cl, K, Ca (Ka, Kb lines).

The beamline will be operated in two modes. In the high flux mode, a multilayer monochromator ($E/\Delta E \approx 30 \div 80$) will focus beam in a 20 μm$\times$500 μm (V$\times$H) spot and provide the high photon flux (10^{15} ph/s @ 5 keV) allowing non-resonant XES measurements of very dilute substances. In order to reduce radiation damages and avoid decomposition, the samples can be maintained under cryogenic conditions ($T \approx 20$ K and helium atmosphere).

Fluorescent X-rays will be analyzed by two in-house designed short radius von Hamos crystal spectrometers. High energy resolution of ΔE=0.2-0.5 eV will be achieved by using diced Si, Ge and quartz crystals optimized for operation at large 82°-55° bragg angles. Taking advantage of a wavelength-dispersive analyzer to record the entire spectrum simultaneously, we will be able to provide very attractive time resolved (2 ms - 10 s) XES measurements. Both spectrometers can be run independently, thus we will be able to record non-resonant XES spectra for two elements simultaneously, so called "two-color" experiments. XANES and XERFD techniques will be available in the second - high monochromatic mode ($E/\Delta E \approx 10000 \div 40000$) with the help of DCM monochromator.



Expected photon flux at the PINK station